DOCUMENT RESUME

ED 266 657 FL 015 501

AUTHOR Moerk, Ernest L.
TITLE The Study of Language from a Skill-Learning Perspective.
PUB DATE Aug 85
NOTE 24p.; Draft of a paper presented at the Annual Meeting of the American Psychological Association (Los Angeles, CA, August 23-27, 1985).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Behavior Theories; Comparative Analysis; *Language Acquisition; Language Processing; *Language Skills; *Learning Theories; *Native Language Instruction; *Skill Development

ABSTRACT

In the controversy over the conceptualization of language and verbal behavior there is an underlying unity of goals and concepts, characterized in the teaching and learning of the first language as acquisition or transmission of skills. Both the behaviorist and cognitive perspectives of learning accommodate this point of view conceptually, if not terminologically. The models provided by these diverse approaches suggest the processes of information intake, rehearsal, and storage together with the independent variables affecting them. Each one of these process interpretations must be based on observations of verbal behavior, its antecedents and consequences, whatever the terminology used in the theory. (Author/MSE)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED266657

The study of language from a skill-learning perspective.

Ernst L. Moerk

California State University, Fresno

Draft of a contribution presented at the Annual Meeting of the American Psychological Association, Los Angeles, CA, August 23-27 as part of a symposium entitled "How shall we study verbal behavior?" (Kurt Salzinger Chair).

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Ernst L. Moerk

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

FL015501

The study of language

from a skill-learning perspective.

Ernst L. Moerk

The recent controversies in the conceptualization of language and verbal behavior might produce the impression that an unbridgeable gulf exists between the diverse schools. In contrast to this first impression, it will be suggested that these controversies are more like squabbles in a family which nevertheless has strong common interests and even exhibits conceptual commonalities beyond the surface divergences. All the branches of 'ecolinguistics,' in Salzinger's (1979) terminology, that is, of the study of language as it occurs in its natural setting, certainly focus upon the same object of study. If they emphasize different aspects of this complex phenomenon, such as the completed product versus the process of producing it, then this complementarity can serve to enrich the final characterization of language and language behavior. In contrast to this consistency of goals, the prevalent controversies appear more like immature sibling rivalries in the family of language-students, due mainly to ingrained habits of using different terminologies which became reified as suggesting separate entitities and hide the similarities in underlying concepts.

A two fold goal follows from this conception: First it will be attempted to build bridges between the diverse approaches in showing an underlying unity of goals and concepts in spite of superficial terminological differences. Then, in the major part of this essay, this conception will be applied to the description of the teaching/learning of a first language from a skill transmission perspective. Skill transmission/acquisition can be and has been conceptualized from a behavioristic learning perspective, involving feedback and frequency effects. But it can equally justifiably

be conceived from a cognitive angle, emphasizing the knowledge gained and the structures of skilled performance.

Terminological contrasts, conceptual similarities:

Since the emphasis of the present symposium is on a behavioristic and specifically the Skinnerian approach to the study of language, some terms from this system will be selected as the focal points for comparison. This ordering of emphasis does, however, not imply an order of importance and even less an order of historical priority.

For many psycholinguists coming from a Piagetian/cognitive background the term 'behaviorism' is in itself an anathema and results in a conditioned aversive reaction. This reaction persists even now that the field of developmental psycholinguistics has turned predominantly to 'pragmatic' studies of language development. The contradiction entailed in these two reactions, the aversive one to everything 'behavioristic' and the positive one to pragmatic approaches seems, however, to have escaped most investigators. The Greek root of 'pragmatic', pratto, means namely 'to act, to behave.' The pragmatic approach is therefore a behavioristic approach, only formulated in Greek terminology. This uniformity of approaches becomes even more evident when some of the major emphases are considered. Skinner, as is well-known, considered speech as an 'operant,' i.e., as a way to 'do things with words' (Austin, 1962). Pragmatically oriented psycholinguists, building upon Austin, analyze 'the functions of language.' In these endeavors both approaches have ancient predecessors. Protagoras and Plato, in ancient Greece, specified a variety of functions of language. Cicero did the same in Rome. And the 'organon model' formulated by Bühler (1934) goes directly back to Aristotle. The Greek term 'organon' translates, of course, as tool, or if you prefer Skinner's Latin inclinations, as operant.

Behavioristic 'habits' are, certainly, behavioral structures that are based upon learned/mental structures, often upon the insight in the three-term contingency pattern. Similar 'habits' are not only well-known from everyday experience as 'speech habits,' they are reappearing in psycholinguistic research as 'formulaic speech' or 'formulae' after the incisive critique of Chomsky's constructive approach by Bolinger (1975). An even more profound homology is worth considering: That is the homology between the three-term contingency pattern and the three-term sentence pattern of Subject - Verb - Object. Certainly both patterns contain the act/verb as the central unit. If the infant eats her food or cuddles her teddy, the Object resembles in many respects the learning theorist's 'reinforcement.' Next to these easy homologies, the challenge remains to specify a homology between the behaviorists' 'stimulus' and the linguists 'subject.' Here I plead 'lack of space' and leave the reader with the invitation to ponder this challenge. Only a preliminary thought shall suffice to provide a possible solution: I often wonder whether the behaviorists are not guilty of an insidious shift in level of analysis in their formulation of the stimulus- response- reinforcement pattern. The 'stimulus' is defined objectively, external of the organism. Yet both the response and the reinforcement carry subjective implications. Objectively defined, as captured, e.g., with a movie camera, one would have a sequence of 'stimulus- stimulus- stimulus' (the light - the lever pressing - the delivery of a pellet). Subjectively defined, one would have something like: 'I receive and interpret a signal - I respond - I enjoy the result/ receive 'reinforcement.' In brief, when remaining on the subjective level of analyses, that is demanded by the term 'response' and 'reinforcement' then the 'subject' certainly becomes important in the behaviorists' three-term contingency pattern.

But these considerations lead too far astray into the field of the philosophy of science and need separate and in-depth analysis. Only a last point of puzzlement - and of underlying similarity - between the squabbling members of the psychological family shall be mentioned here: It is surprising how a research tradition that employs so frequently the terms response, reinforcement, learning, or habit would deny that the approach is -at least closet-mentalistic. What does learning mean if not a mental process. A response is a mentalistic concept because objectively only movement-stimuli could be recorded. On the other hand, it is well-known that Chomsky in his structural approach is a direct heir of Z. S. Harris (1951) and an indirect one of the behavioristic approach to language by Bloomfield (1933), who in turn was profoundly influenced by Watson's behaviorism. How profoundly 'behavioristic' Chomsky's leaning was is still seen in his early and prolonged attempts to exclude meaning from his linguistic analyses (Chomsky, 1957).

Having suggested some broad homologies and agreements between the conflicting approaches to psycholinguistic research, more specific support shall be provided from the extensive and intensive research on first language transmission/acquisition. Due to the breadth of the field and temporal/spatial limitations, the specific aspects will be discussed mainly conceptually, relying upon past research. The interactional examples that will be provided are derived from the analysis of the interaction corpora of Eve, the famous subject of Roger Brown's, with her mother. Specifics about the subject is, of course, provided by Brown (1973). Moerk (1983a, 1985a, b) provides the necessary data and also those pertaining to the analytical methodology in more condensed form.

As indicated in the first part of this study, it is now increasingly accepted that language is used as a 'tool', a 'skill', an 'operant', or

'functionally', as the diverse terms are applied in different 'schools.' The paradigm employed in the following analysis will therefore, be that of skill transmission/acquisition. The justification of this paradigm cannot be fully explored in this paper; it has been done in Moerk (1985c) and will become at least partially evident when specific phenomena of this process are demonstrated.

In order to learn a skill, a model is generally observed and imitated by the apprentice. The effects of imitation upon language acquisition have been widely discussed and increasingly demonstrated. Snow (1981) has given a recent excellent summary of the most relevant evidence. What might be more interesting from the behavioristic perspective is how mothers can and do systematically train and reward a habit of 'generalized imitation' in the sense of Baer and Sherman (1964) or Gewirtz and Stingle (1968). Table 1 presents an example of this phenomenon, taken from the interactions of Eve and her mother.

Insert Table 1 about here

Translating the term 'positive feedback' in the table as 'reinforcement', the three-term contingency pattern is highly obvious and impressive as to the consistency of reinforcement-provisions by the mother. It has, however, to be added that in the case of Adam, the second of Brown's famous subjects, this pattern was not found. Whether this was due to the fact that Adam was older at the begining of the recording and that, therefore the members of the dyad had progressed to different interaction patterns, or whether it is due to idiosyncratic differences in the dyads could not be established. This contrast accords, however, well with the findings in the literature: By far

not all children employ intensive imitation as a language learning tool (e.g., Bloom, Hood & Lightbown, 1974). The behaviorist at least would suspect that these differences might be based upon differential reinforcement histories. To the knowledge of the writer, no systematic research exists on this topic. The comparison of Adam and Eve interacting with their mothers (Moerk, 1985b) rests obviously upon too small a sample to draw normative conclusions.

In skill learning, feedback is of great importance; both positive feedback indicating for the learner when he has progressed and to reward him and negative feedback to point out flaws and insufficiencies. In the nativistically influenced literature, both types of feedback were categorically denied, largely based upon the assertions by Brown and Hanlon (1970). As to positive reinforcement, Salzinger (1978) has argued that Brown's definition was much too narrow and that probably many of the real life reinforcers were overlooked in his study. Nevertheless, even within relatively narrow definitions, Holzman (1983) and Moerk (1983a, b) have shown that 'rewards', mostly in the form of yes or something equivalent, are quite frequent. On the other hand, it is equally known both from skill-learning and from behavioristic research that reward does not need to be continuous and consistent. Ribes (1985) has shown and argued that specific linguistic skills can be learned without any obvious and systematic provision of rewards.

As to the theoretically even more important negative feedback, the situation at present is similar. After more than a decade's outright denial of their existence, a closer look at actual verbal interactions showed them to be quite common. First of all, Brown's well-known 'expansions' are one form of correction in themselves. Even more specific forms of correction have been reported by Moerk (1983a, b) and by Hirsh-Pasek, Treiman and

and Schneiderman (1984). In the laboratory of Snow at Harvard, analyses similar to Moerk's are at present performed (Demetras & Post, 1985) and corrections are found again. It has, therefore to be concluded, that the third term in the three-term contingency pattern can be found indeed, whether in its positive or negative form.

In any skill learning, frequency of modeling and of exercise are of great significance. Such frequency effects too have been generally denied, based largely upon conclusions arrived at in Brown's (1973) classic book. This premature denial fit so excellently into the nativistic ideology that researchers forgot not only to consider the data objectively but even Brown's preceding reports (Brown, Cazden & Bellugi, 1969; Brown & Hanlon, 1970) that testified to frequency effects. Moerk (1980) responded directly to Brown's data by showing strong correlations between input frequency and speed of acquisition. Forner (1977), using a different subset of Brown's data came to a very similar conclusion, reporting also high correlations. Two summaries by Moerk (1985c) and by Rondal (1985) provide more extensive supporting evidence as to frequency effects. But even Brown in his now classic book adduced at least tangential support for such a learning-theoretical interpretation, based upon cumulative frequency effects, as against a cognitive hypothesis-testing conceptualization. He pointed out that in most instances of the acquisition of one specific linguistic item, the acquisition proceeded incrementally, not in a 'all or none fashion' as suggested by hypothesis-testing conceptualizations. Such an incremental acquisition has been repeatedly found in the author's analyses of the data of Adam and Eve and it will be soon quantified with the help of time-series analysis. The well-known exponential learning curves of Skinner's reflect a similar process of incremental learning based upon number of trials. The parallels are obvious

here, though they still need to be systematically demonstrated in language acquisition research.

Having once accepted the potenital impact of input and exercise frequency, the question as to the effects of massing vs. spacing is immediately suggested within the skill learning paradigm. Since frequency effects were generally denied, this more differentiated question was mostly not even considered. Yet evidence exists again and it is summarized by the same two authors (Moerk, 1985c; Rondal 1985). As in much learning of new material, a certain degree of initial massing - to counteract forgetting during the intervals - followed by spacing with increasingly longer intervals, is conducive to the rapid acquisition and prolonged retention. Estes (1978) has lucidly discussed the learning theoretical perspective relevant to this question. Table 2 shall provide an example from language teaching and learning. It is again derived from the interactions of Eve and her mother.

Insert Table 2 about here

Whereas the table is convincing enough in respect to the massing of the initial training of the items, it would have been too cumbersome to fully demonstrate the spacing. The entire process, as observable within one hour of interaction is given in Figure 1. From broadly observed evidence not related to this specific item, it only needs to be added that similar spaced rehearsals are generally found after longer intervals too, that is in subsequent recording sessions. It has, therefore, to be assumed that they will also have occurred during the many hours of interactions that were not recorded between the prearranged sessions. To capture the complete history of the learning of even one single linguistic item, continuous and exhaustive

observation would be needed. No pertinent data seem to have been collected to the knowledge of the writer.

Insert Figure 1 about here

Table 1 together with the above discussions of positive feedback and corrections have indicated that in these mother-child interactions contingencies are all-pervasive. In the model - imitation - reinforcement situation, one finds - almost - exactly the behavioristic three-term contingency pattern. Yet one difference exists, whose importance appears to be most profound. In the model - imitation situation, isomorphy between the stimulus and the response exists, Skinner's (1957) echoic behavior. With this partial or full isomorphy an understanding of the structure of the response and of the development of this structure becomes possible. With this opportunity, a profound weakness in the behavioristic approach can be remedied: The behaviorists seem profoundly uninterested in the form the behavior, i.e., the response, takes. As known, Skinner focuses upon 'response classes' only and specific responses are readily substitutable in this class, such as the bar pressing with the right paw, the left paw, etc. Already Lashley (1951) and Chomsky (1959) have emphasized this weakness. Adams (1984) has analyzed it carefully and provided a survey of approaches that remedy this lack of behavioristic interest in behavior. Skill learning and especially language learning are optimal fields to explore these questions in more depth since the structure of the behavior is of much greater interest in these fields than just the contingency as to when it is produced.

That the contingencies are certainly of great value in understanding the learning process is hereby not to be denied. The writer has focused

extensively upon them in adopting Markov chain models with their transitional and joint probabilities to the analysis of mother-child interactions (Moerk, 1983a, b, 1985a, b). An integration of structural and contingency analysis is, therefore, needed. The field of developmental lingusitics is aiming in this direction in combining a Chomskyan/structural emphasis with a pragmatic emphasis focusing upon interutterance relationships. Shatz (1982) has drawn attention to the value of these analyses.

A more conceptual side-remark is appropriate here, even if it interrupts the flow of factual analyses: In the first section of this essay, attention was drawn to the parrells between the behavioristic 'three-term contingency pattern' and the subject - verb - object sentence structure. In the second-last paragraph it was specified that Skinner emphasized 'response classes'. He equally emphasized 'stimulus classes' and not specific narrowly circumscribed stimuli; and of course, the reinforcements are substitutable in accordance with the specific deprivation state of the organism. Considering these principles, it becomes evident that this combination of general structure and substitutable items is closely equivalent to linguistic structures and the slot-and-filler principle that is so generally trained in substitution exercises in the course of second language acquisition. Instead of 'stimulus 'class' and 'response class' we have 'noun class' and 'verb class', and the stimulus/noun class can appear both as S^D and S^R. Whether this is a superficial analogy or a meaningful homology is again left to the judgement of the critical reader.

In judging this question, two further kinds of substitution might deserve consideration. One is performed by the infant in the one-to-two-word stage when he integrates nonverbal and verbal elements in order to convey a message. Rebus-writing represents a similar principle in a playful manner. The

second has been discussed extensively by Ribes (1985) as 'substitutional mediation', i.e., that verbal events can become independent of external controlling stimuli. A continuum of substitution appears to exist from a shift from the left to the right paw, to verbal substitution drills, to Ribes' mediational substitution.

Having focused upon the training and acquisition of lingusitic skills, the topics of retention, recognition, and recall have been neglected in the above sections. They certainly deserve extensive discussion. Only a few preliminary remarks can be added here: Retention has been briefly and indirectly touched upon in the discussion of massed vs. spaced rehearsals. Massing is a means to assure retention in short-term memory and sufficient rehearsal so that it will be transferred into more long-term storage. Initially, the danger of decay is great even in this longer-term storage and relatively densily spaced reinstatements counteract it. Moerk (1985d) has provided evidence for this from mother-child interactions. The more assured the storage, the longer can the intervals be between reinstatements, as exemplified in Figure 1. These principles remind, of course, of Eppinghaus and of most of the learning and memory research since then.

Memory research has generally shown that recognition is easier than recall; one of the better supported findings. Under a different terminology, this same finding is widely accpeted in the field of first language acquisition: Comprehension comes before imitation, and the latter comes before spontaneous production. Whitehurst (1977) has discussed this principle in detail and has provided supportive evidence. The same phenomenon is well-known from second language learning; it is painfully well-known from personal experience in trying to recall somebody's name, which one could recognize so easily when mentioned. An overarching principle is evident from these observations.

Whitehurst's (1977) discussion entails, however, a finer differentiation than just recognition vs. recall. With modeling and imitation the principle of cueing or priming is involved. The child can produce linguistic items better if they have been cued shortly before. Estes (1978) has analyzed the effects of priming and rehearsal in great detail and he has also pointed out the close parallels between the terms 'priming' and 'rehearsal' as used in cognitive theory and those of 'sensitization' and 'reinstatement' as employed in behavioristic learning theory. The facts and principles can, therefore, be assumed as well established. Moerk (1985d) has provided some preliminary analyses as to the involvement of the various memory stores: from sensory register, to short-term memory, and long-term storage and the entailed levels of processing in the case of the training/learning of specific linguistic items. Yet, the work on the detailed exploration of these processes based upon verbal interactions has barely begun.

These last explanatory attempts might, however, indicate an apt answer to the question formulated as the theme of the present symposium: How shall we study verbal behavior? Reformulated for the purposes of the present subtopic, the question would be: How shall we study the acquisition of verbal behavior and verbal skills? In answering it, the valuable models provided by the diverse learning theoretical approaches, whether they are behavioristic or cognitive, were indicated. These models suggest the processes of information intake, rehearsal, and storage together with the independent variables affecting them. Each one of these process interpretations has to be based upon observations of verbal behavior, its antecedents, and consequences, whatever the specific termini technici the diverse theories might be employing. To understand real-life language acquisition, antecedents, behaviors, and consequences must be a representative

sample of those observable in the everyday environments, that is, the observations must be ecologically valid. Salzinger's (1979) call for a new "ecolinguistics" expresses convincingly the need for this approach.

References

Adams, J. A. (1984). Learning of movement sequences. Psychological Bulletin, 96, 3-28.

Austin, J. L. (1962). How to do things with words London: Oxford Univ. Press.

Baer, D. M., & Sherman, J. A. (1964). Reinforcement control of generalized imitation in young children. Journal of Experimental Child Psychology, 1, 37-49.

Bloom, L. M., Hood, L., & Lightbown, P. (1974). Imitation in language development: if, when, and why. Cognitive Psychology, 6, 380-420.

Bloomfield, L. (1933). Language. New York: Holt.

Bolinger, D. (1975). Aspects of language. (2nd ed.) New York: Harcourt Brace & Jovanovich.

Brown, R. (1973). A first language. The early stages. Cambridge, Mass.: Harvard University Press.

Brown, R., Cazden, C., & Bellugi, U. (1969). The child's grammar from I to III. In J. P. Hill (Ed.), The 1967 Minnesota Symposium on Child Psychology. (pp. 28-73). Minneapolis: University of Minnesota Press.

Brown, R., & Hanlon, C. (1970). Derivational complexity and order of acquisition in child speech. In J.R. Hayes (Ed.), Cognition and the development of language. (pp. 11-53). New York: John Wiley & Sons

Bühler, K. (1934). Sprachtheorie. Jena: G. Fischer.

Chomsky, N. (1957). Syntactic structures. The Hague: Mouton.

Chomsky, N. (1959). Review of Skinner's Verbal behavior. Language, 35(1), 26-58.

Demetras, M. J., & Post, K. N., An analysis of negative feedback in mother-child dialogues. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Toronto, Canada, April 25-28, 1985.

Estes, W. K. (1978). On the organization and core concepts of learning theory and cognitive psychology. In W. K. Estes (Ed.), Handbook of learning and cognitive processes. Vol. 6. Linguistic functions and cognitive theory. (pp. 235-292). Hillsdale, N. J.: Lawrence Erlbaum Association.

Forner, M. (1977). The mother as LAD: Interaction between order and frequency of parental input and child production. Unpublished manuscript.

Gewirtz, J. L., & Stingle, K. G. (1968). The learning of generalized imitation as the basis for identification. Psychological Review, 75, 374-397.

Harris, Z. S. (1951). Methods in structural linguistics. Chicago: University of Chicago Press.

Hirsh-Pasek, K., Treiman, R., & Schneiderman, M. (1984). Brown & Hanlon revisited: mothers' sensitivity to ungrammatical forms. Journal of Child Language, 11, 81-88.

Holzman, M. (1983). The language of children: Development in home and school. Englewood Cliffs; Prentice Hall.

Lashley, K. S. (1951). The problem of serial order in behavior. In L. A. Jeffrees (Ed.), Cerebral mechanisms in behavior. (pp. 112-136). New York: Wiley.

Moerk, E. L. (1980). Relationships between parental input frequencies and children's language acquisition: a reanalysis of Brown's data. Journal of Child Language, 7, 105-118.

Moerk, E. L. (1983a). The mother of Eve-- as a first language teacher. Norwood, N. J.: Ablex Publishing Corp.

Moerk, E. L. (1983b). A behavioral analysis of controversial topics in first language acquisition: Reinforcements, corrections, modeling, input frequencies, and the three-term contingency pattern. Journal of Psycholinguistic Research, 12, 129-155.

Moerk, E. L. (1985a). Analytic, synthetic, abstracting and word-class defining aspects of verbal mother-child interactions. Journal of Psycholinguistic Research, 14, 263-287.

Moerk, E. L. (1985b). A differential interactive analysis of language teaching and learning. Discourse Processes, 8, 113-142.

Moerk, E. L. (1985c). Environmental factors in early language acquisition. In G. J. Whitehurst (Ed.), Annals of child development. Vol. 3. (pp.) Greenwich, Connecticut: JAI Press.

Moerk, E. L. (1985d) Procedures and processes of first language teaching and learning. Paper presented at the First International Congress of Applied Psycholinguistics, Barcelona, June, 1985.

Rondal, J. A. (1985). Adult-child interaction and the process of language acquisition. New York: Praeger.

Ribes, E. (1985). Language as behavior: functional mediation vs. morphological description. In H. W. Reese & L. Parrott (Eds.), Advances in behavior science. (pp. -). Hillsdale, N. J.: Lawrence Erlbaum.

Salzinger, K. (1978). Language behavior. In A. C. Catania & T. A. Brigham (Eds.), Handbook of applied behavior analysis: Social and instructional processes. New York: Halsted.

Salzinger, K. (1979). Ecolinguistics: A radical behavior theory approach to language behavior. In D. Aaronson & R. W. Rieber (Eds.), Psycholinguistic research: Implications and applications. Hillsdale, N. J.: Lawrence Erlbaum.

Shatz, M. (1982). On mechanisms of language acquisition: Can features of the communicative environment account for development? In E. Wanner & L. R. Gleitman (Eds.), Language acquisition. The state of the art. (pp. 102-127). Cambridge: Cambridge University Press.

Skinner, B. F. (1957). Verbal behavior. New York: Appleton-Century-Crofts.

Snow, C. E. (1981). The uses of imitation. Journal of Child Language, 8, 205-212.

Whitehurst, G. J. (1977). Comprehension, selective imitation, and the CIP hypothesis. Journal of Experimental Child Psychology, 23, 23-38.

TABLE 1

Triple sequences of instructional interaction of the pattern: maternal teaching - filial learning - maternal teaching. Data from Eve and her mother.

Maternal technique	Filial strategy	Matern. Technique	Frequency
Vocabulary persev.	Reduction	Positive feedback	20
Frame variation	Reduction	Positive feedback	19
Morpheme persever.	Reduction	Positive Feedback	13
Substitution drill	Reduction	Positive feedback	12
Description	Reduction	Positive feedback	12
Vocabulary persev.	Reduction	Vocabulary persev.	11
Substitution drill	Reduction	Expansion	11
Substitution drill	Reduction	Imitative self rep.	10
Expansion	Reduction	Expansion	9
Substitution drill	Reduction	Description	9
Frame variation	Reduction	Vocabulary persev.	9
Break-down sequ.	Reduction	Positive feedback	9
Opt. transformation	Reduction	Expansion	8
Description	Reduction	Expansion	8
Vocabulary persev.	Imit. self rep.	Vocabulary persev.	8
Expansion	Reduction	Positive feedback	7
Opt. transformation	Reducation	Positive feedback	7
Substitution drill	Reduction	Uncodable	6
Vocabulary persev.	Reduction	Imitative self rep.	6
Vocabulary persev.	Imit. self rep.	Positive feedback	6
Frame variation	Chaining imit.	Positive feedback	6
Frame variation	Reduction	Opt. transformation	6
Imitative self rep.	Imit. self rep.	Positive feedback	5
Opt. transformation	Reduction	Vocabulary persev.	5
Frame variation	Reduction	Morpheme persever.	5
Frame variation	Reduction	Substitution drill	5
Description	Reduction	Frame variation	5
			238

Table 2

The introduction of two new vocabulary items:'crack' and 'nut.'

Utterance #	Child's utterance	Mother's utterance
1	That?	
2		Those are nuts.
3	..... peel nut.	
4		You want to peel the nut?
5		Well, I'm cracking the nuts.
6	..... (crack) nut.	
7		No. You don't know how to crack the nuts.
10	..... (crack) nut(s) [2x]	
11		You can't crack the nuts.
12		I'm cracking the nuts.
14		I'm cracking the nuts.
18		Would you like to have a nut? There.
19	There. ..... crack nut.	
22		Why don't you see if the tinker toy would crack the nut.
27		Go crack it with the tinkter toy
33	(( )) crack nut.	
36	Eve crack nut.	
37	..... crack nut.	
38		Eve's cracking the nut?
52	.....crack nut.	
53	(I) crack nut.	
54		Did you, did you crack the nut?
Repeated:	60,62,64,69,92,98,101, 170, 173, 175 188, 191, 279, 282; 2 pp later, 3 pp later, 4 pp later.	56,57,61,63,65,68,70,93,102,171,172,174,176, 178,180,189,190,225,240,241,256,272,273,275, 276, 280, 283, 286, 287; 2pp/3pp/4pp later.

BEST COPY AVAILABLE

Figure 1

Massed training and spaced rehearsals of two new vocabulary items